Menlo Park Notebook #228 [N-81-08-30]

This notebook covers the period August-October 1881. The entries are by Francis Jehl and consist of notes and calculations relating to meter experiments. There are two labels on the front cover marked "Meters" and "Edison Machine Works Francis Jehl." The book contains 280 numbered pages. Pages 260-275 contain skeleton tables that were never filled in. They have not been filmed.

Blank pages not filmed: 278-279.

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May 1, 1896

Meter Experiments,

August 30 1881

Tested the resistence of the shunts of two meters with the following results

Number 1

Resistence of long shunt .0112 ohm
" " short " .0028 "
" " both " .014 "

Number 2

Resistence of long shunt .0114 ohm
" " short shunt .0029 "
" " both shunts .0143 "

August 31 1881 *

I connected the two meters in series, and passed a ten Ballard cells in multiple arc and obtained the electromotive force from each shunt.

One standard cell gave a deflection of 346 - 343, = 1.079 volt.

#1 long shunt 51 - 52 = .1612036 volt.
#1 both shunts 65 - 64 = .2019888 volt.
#2 long shunt 59 - 59.5 = .1667055 volt.
#2 both shunts 66 - 66 = .2062048 volt.

Deflection of 1 standard cell = 345 - 343

#1 short shunt 18.5 - 11.5 = .0391677 volt.
#2 short shunt 12 - 14 = .0406789 volt.

Calculated current through each,

#1 long shunt = 14.392 veber,
#1 short shunt = 14.985 veber,
#1 both shunts = 18.985 veber,
#2 long shunt = 14.427 veber,
#2 short shunt = 14.623 veber,
#2 both shunts = 14.000 veber,
14.412 veber.

3.D ohms

September 1st

A Deposition Cell, plates separated by $\frac{10}{1000}$ of an inch, and the deflection when put on the high resistance galvanometer, with no intervening resistance, is 90. Standard Battery, when short-circuited on 10.000 ohms, and the galvanometer shunted on 30 ohms gives a deflection of 90. ~~1.79 ohms~~ 1.079

September 1, 1887

I put 100 cu. cm. of solution of sulphate of copper in 5 bottles. To #1 added 5 drops of sulphuric acid, #2 10 drops, #3. 15 drops, #4 no acid and #5, 3 drops.

September 2nd 1887

Tested the resistence of the wire spools. The resistence varied from 3. to 3.22 ohms at 85° Fahr. which is too low.

Had them wound over again with more wire and adjusted the resistence to 3.33 ohms each which equals 3 ohms at zero C.

Attached each coil to a bottle of standard solution and found resistence about 4.0 ohms. Added 5 drops of sulphuric acid to each which brought the resistence down to about 4.04 ohms.

Sept 2nd 1881

I weighed the eight copper belonging to the meters in air and in water with following result

#1	in air	71.871175	in water	63.8879
#2	in air	80.956	"	"	71.912
#3	"	"	80.7166	"	"	71.7124
#4	"	"	78.1344	"	"	69.3972
#5	"	"	79.4445	"	"	70.55995
#6	"	"	77.2377	"	"	68.6201
#7	"	"	76.9668	"	"	68.384225
#8	"	"	75.9124	"	"	67.4513

temperature of water 83° F.

From the above I calculated the specific gravity as follows.

#1	Specific Gravity	8.96
#2	"	"	8.95
#3	"	"	8.96
#4	"	"	8.94
#5	"	"	8.94
#6	"	"	8.96
#7	"	"	8.96
#8	"	"	8.97

Sept 2 7

Put the bottles in the meters as follows

#1 meter.

Monthly bottle copper # 6 + 4.
Yearly bottle " # 3 + 5.

#2 meter.

Monthly bottle copper # 7 + 2.
Yearly bottle " # 1 + 8.

Put the meters in series and passed a current through them from ten Gallaud cells connected in multiple arc.

Started at 6.58 o'clock P.M.

Disconnected the meters at 12.58 P.M. Sept 3. having been connected 18 hours.

Sept 3d,

Took out the coppers and weighed them in air and water.

#1 Meter

Monthly bot # 6 & 4 coppers.
#6 in water 68.62445 in air 77.2507
#4 " " 69.29355 " " 78.0447
very few deposit.

Yearly Bot. # 3 & 5 coppers.
#3 in water 71.67515 in air 80.718
#5 " " 70.58055 " " 79.4895

#2 Meter

Monthly bot # 7 & 2 coppers.
#7 in water 68.482575 in air 77.1225
#2 " " 71.7956 " " 80.780
Yearly bot # 1 & 8 coppers.
#1 in water 63.81385 in air 71.8786
#8 " " 67.39805 " " 75.9074.

Sept 8 1887

Before removing the meters I obtained the electromotive-face.

Standard cell def 336–328

#1 Meter def 69–67 = .2242162 volts
#2 " " 65–67 = .2177422 "
Both " " 141–144 = .4634305 "

Calculated resistance of #1 meter .01395
" " " of #2 " .01425
" " total " .002944
.03064

Calculated current #1 meter 15.20 webers
" " #2 " 14.46 "
" " both " 15.12 "

#1 Meter

Part of current through
monthly bottle .0627 6
yearly " .00069

#2 Meter

monthly bottle .002781
yearly " .00271

A current of 1 weber will deposit 173.6 mg per hour.

Sept 8d 1881

Set the meters in circuit again at 6,55 P.M. with the coppers reversed this.

#1 Meter

Monthly bottle coppers # 4 & 6
Yearly bottle " # 5 & 3

#2 Meter

Monthly bottle coppers # 2 & 7
Yearly bottle " # 8 & 1

The deposit obtained in the eighteen hours was as follows, calculated.

Deposit on #6. 13 mg. } 890.58 mg
Taken from #4. 87.7 " }
Deposited on #3. 1.4 " } 205.14 "
Taken on #5. 4.0 " }
Deposited on #7. 55.7 " } 735.44 "
Taken from #2. 176 " }
Deposited on #1. 1.425 " } 211.08 "
Taken from #8. 5.0 " }

Sept 5 1881

Disconnected meters at 9.25 A.M. having been connected 38½ hours.

Coppers weighed as follows,

#1 Meter

Monthly bottle
#4 in water 69.19085 in air 78.13085
#6 " " 68.37895 " " 77.0136

#2 Meter

Monthly bobble
#2 in water 71.92255 in air 80.9755
#7 " " 68.29445 " " 76.91445

#1 Meter

Yearly bottle
#5 in water 70.53055 in air 79.43935
#3 " " 71.6686 " " 80.711925

#2 Meter

Yearly bottle
#8 in water 67.3971 in air 75.9067
#1 " " 63.8058 " " 71.8639

Copper #1 having a poor thread on substituted for it another weighing in water 66,622175 in air 74.98588 before putting in the circuit again.

Sept 5 1881

Wt. difference in weight of the copper is as follows,

Deposited on #4, 86.15 mg.	}	Calculated
Taken from #6. 237.1 "		1870.58604 mg.
Deposited on #2, 195.5 "	}	
Taken from #7. 208.05 "		1904.48874 mg.
Taken from #8. .7 mg.	}	
" " #1. 8.7 "		487.20634 mg.
" " #5. .15 "	}	
" " #8, 7.0 "		467.65026 mg.

Put the meters in circuit again at 4.35 & 6 & 8 PM, connected as follows

#1 Meter

Monthly bottle 6 & 4.

Yearly bottle 8 & 5.

#2 Meter

Monthly bottle 7 & 2

Yearly bottle 1 (new) & 8.

Disconnected meters at 8.35 A.M. Sept 6, having been on 16 hours

Sept 6 to 1881

The coppers weighed as follows.

#1 Meter

Monthly bottle

#6 in air 77.12745 in water 68.4842 mg

#4 " " 78.0054 " " 69.262675 "

Yearly bottle

#3 in air 80.707825 in water 71.66925

#5 " " 79.43385 " " 70.5808

#2 Meter

Monthly bottle

#7 in air 77.02955 in water 68.41855

#2 " " 71.77795 " " air 80.80715

Yearly bottle

#1 in air 75.0205 in water 66.61555

#8 " " 75.8955 " " 67.38885

Deposited on #6, 113.85 mg.	}	calculated
Taken from #4, 125.45 "		777.39264 mg.
Deposited on #3, 4.1 "	}	
Taken from #5. 5.5 "		194.34816 "
Deposited on #7, 116.1 "	}	
Taken from #2. 168.35 "		781.47584 "
Deposited on #1, 34.65 "	}	
Taken from #8, 11.2 "		199.98144 "

Sept 6 th 1881

Connected the meters again at 2.25 P. M. as follows

#1 Meter

Monthly bottle copper 4 & 6.
Yearly bottle " 5 & 3.

#2 Meter.

Monthly bottle copper 2 & 7.
Yearly bottle " 8 & 1.

Sept 7 1881

Disconnected meters at 8.25 A.M. having been on 18 hours.

Bottles weighed as follows,

#1 Meter

Monthly bottle #4 & 6

#4 in air 78.1255 — in water 69.37775 @ 80°
#6 in air 76.99915 " " 68.3686 "

Yearly bottle

#5 in air 79.4834 in water 70.58305 "
#3 in air 80.7016 " " 71.66905 "

#2 Meter

Monthly bottle

#2 in air 80.92055 in water 71.87925 "
#7 " " 76.875475 " " 68.2766 "

Yearly bottle

#8 in air 75.89115 " " 67.3892 "
#1 " " 76.87225 " " 66.616.6 "

Deposits were as follows

Deposited on #4	120.1 mg.	calculated,
Taken off #6	134.8 "	820.58 mg,
Deposited on #2	113.4 "	
Taken off #7	153.075 "	735.44 "
" " #5	0.445 "	
" " #3	6.326 "	805.14 "
" " #8	4.35 "	
" " #1	3.275 "	811.08 "

Sept 7 1887

I filled the bottles with standard solution of sulphate of copper without any acid, and connected them with several Gallons bells in multiple arc, at 4.35 P. M.

I previously cleaned coppers #4 & 6 in dilute nitric acid, they then weighed
#4 in air 78.1055 in water 69.3762 mg
#6 " " 76.9704 " " 68.3438 "

Coppers were arranged thus

#1 Meter
Monthly bottle coppers 6 & 4,
Yearly bottle " 3 & 5.
#2 Meter
Monthly bottle, coppers 7 & 2.
Yearly bottle " 1 & 8.

I took 6 pieces of copper and deposited upon them from 6 other pieces with the current from the dynamo in the morning continuous at with two breaks between.

Sept 8 1887

Disconnected meter at 9.25 A.M. having been on 17 hours.

The coppers weighed as follows in water @ 88° Fahr.

#1 Meter.
Monthly bottle
#4, 69.3692 grams,
#6, 68.3238 "
Yearly bottle
#5. 70.5304 grams.
#3, 71.6635 "
#2 Meter.
Monthly bottle
#7. 68.2595 grams,
#2. 71.868825 " .
Yearly bottle
#1 66.619.175 "
#8 67.384.6 "

Sept 8 1887

The deposits were as follows

#6 Taken off #6. 19.5 mg.
Taken off #2. 20.425 "
Taken off #4. 7 mg.
Taken off #7. 17 mg.
Taken off #5. 2.65 mg.
Taken off #1. 2.575 mg.
Taken off #3. 5.55 mg.
Taken off #8. 4.6 "

Took four bottles of standard solution and put meter plates in each and passed a current from one cell and through them connected in series.

Copper in bottle #1 weighed in water 71,858.25 mg x 68,259.5 mg.

bottle #2
66,619.175 mg x 67,384.6 mg.

bottle #3
69,869.2 mg x 68,323.8 mg.

bottle #4
71,663.5 mg x 70,530.4 mg.

Sept 8 1887

Weights copper as follows.

#1 Bottle
72,983.6 x 67,181.7 mg

#2 Bottle
68,463.6 x 66,545.825 mg

#3 Bottle
69,407.4 x 68,280.45 mg

#4 Bottle
71,612.95 x 70,721.7 mg

The difference in weight was

#1 { 1.077675 Deposit
1.0778 Dissolved

#2 { 1.078 Deposit
1.07885 Dissolved

#3 { 1.0836 Deposit
1.08875 Dissolve

#4 { 1.08255 Deposit
.9418 Dissolve

Added 2 drops of dilute sulphuric acid (1 to 5) to each bottle and connected again at 5.10 P.M.

20 Sept 8th 1887

Disconnected at 8.05 P.M.
having been on 2 hour & 55 minutes.
The copper weighed as follows
#1 bottle

68,880 + 71,6679
66,7446 + 67,194,65

#3 bottle

69,475425 + 68,10625

#4 bottle

71,790025 + 70,8612

The deposits were as follows

#1 { 1,1983 Deposit
1,2686 Dissolved

#2 { 1,199135 Deposit
1,26905 Dissolved

#3 { 1,194975 Deposit
1,30115 Dissolved

#4 { 1,068325 Deposit
1,25175 Dissolved

Sept 9. 1887 21

I gilded the connections of two bottles, and passed a current of 1 Ballard cell through 400 ohms resistance through them, started at 10.50 A. M.

The copper weighed as follows

#1 bottle

66,67305 + 67,07835 grams

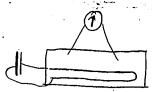
#2 bottle

67,9489 + 69,32695

~~#3 bottle~~

22 September 9 — 1881

I took a standard Daniel Cell and connected it in circuit with 10000 Ohms, and then shunted the Thompsons high resistance Galvanometer with out any resistance in at the following resistances which gave the following results.



1Dif	on	5 Ohms	9.
"	"	10 "	18
"	"	20 "	80
"	"	50 "	965

10000 / 50 / 200) 1.079 (5.395

1715 336 4x50

96) 5 0 6 3 9 5 0 0 0 (5 2 7 5 6 1 9 7 9 (5)

4 8 0 — 96

5 7 5 — 5 5 7 1 8 7 4

5 7 6 — 5 0 5 7 8 1 1

1 9 0 — 5 3 7 4 9 9 8 4

96

Connected

9 4 0

8 6 4

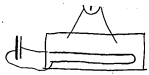
7 6 0

6 7 2

8 8 0

8 6 4

22 September 9 — 1881



Def	on	5	Ohms	9°
"	"	10	"	18
"	"	20	"	30
"	"	60	"	96,5

10000 / 50 = 200) 1,079 (5395

1715 336
3420

23

A deflection without any resistance through the galvanometer of 96 = ,0005395 volts

94) 0005395000 (00005 5156
480
X 495 X error
480
150
94
540
480
600
576

One division equals ~~,0000056198~~ of a Volt.

Deflection from a Copper Deposition Cell.

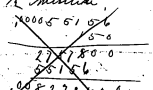
No current ever having passed through the cell when put in direct to the galvanometer showed 14 divisions and this X by the above constant gives the Electromotive force.

,00005 6198
224792
56198
,0007 86772

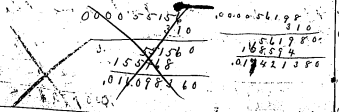
10000 5516
224824
550
,0007 7214

Then I set up the same disposition cell so as to pass a current through it.

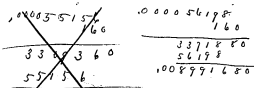
With current on the cell and the current off and ~~the~~ put on the galvanometer gave a deflection of 150 which was quite steady. The above cell had the current on only about ½ minute.



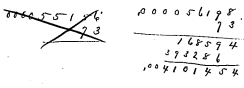
A Current after being on about 1½ hours the deflection was 310 and from that it went down to 160, the first deflection is = to



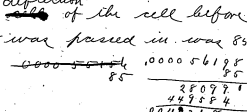
The second – 160 – which seemed to remain constant is = to



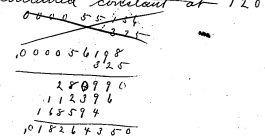
I then took the disposition cell and shook it and bobbed the plate up and down several times and it gave a dif of 73 which in volts is equal



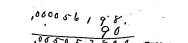
I then put one drop of H_2SO_4 into the solution of Copper Sulph. and stirred it in. The deflection of the cell before any current was passed in was 85



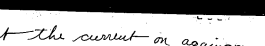
Then I put the current on for 3 min.
Then the diff first way 325
and it remained constant at 120



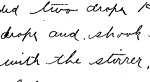
Then put into the cell another drop of Na_2S_{0x} — Then the diff before the current was put on was 91



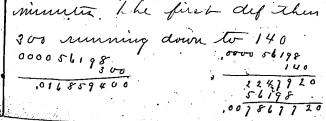
Then I put the current on again for three minutes. The deflection remained constant at 120



Then I added two drops Na_2S_{0x} (making in all four drops) and shook the solution up with the stirrer. The diff then before current was put on was 91



Then put on the current for three minutes. The first diff then was 300 running down to 140



I then added 4 drops H_2SO_4 (making 8) The def then before putting current on was 200.

~~Then put~~

```
,0000561978
        200
,0112239600
```

Then put current on for three minutes and the def obtained was 240

```
,0000561978
        240
 224792
 112396
,0134875720
```

Then put the current on for ten minutes and the def was 205

```
,0000561978
        205
 1209990
 112396
,0115209590
```


I then added four more drops H_2SO_4 ~~and~~ (making 12) and the def before the current was put on was 2.65.

```
,0000561978
        265
 2809970
 337188
 112396
,0148972470
```

Then I put on the current for five minutes and the def was 231.

```
,0000561978
        231
 561978
 168594
 112396
,0129811738
```

I then put in four more drops acid (making 16) and stirred the solution

The deflection was 245 before current was put on.

```
,0000561978
        245
 2809970
 224792
 112396
,0137685710
```

Then put on the current for five minutes and the def was 205

(over)

,0000 56198
206
280790
112396
,0116205 90

I then reclaimed the plates with N. N. Os and replaced them with the addition of 4 drops N_2SO_4 (making 20) The def then before current was put on was 132,

~~Fifteen~~ ,0000 56198
132
112396
168594
56198
,0074158136

I then put on the current for five minutes and def = 115

0000 56198
115
280790
56198
56198
,0064462770

I then added 10 drops N_2SO_4 (making 30) and the def = 46

,0000 56198
46
337188
224792
,0025851 08

Then put the current on for five minutes and the def = 105

,0000 56198
105
280790
56198
,0059068790

Put in five more drops N_2SO_4 (making 40) and the def without current was 80

,0000 56198
80
,0044955840

Put the current on for one-half minute and the def = 110

,0000 56198
110
561980
56198
,0061781780

Put in ten more drops (making 50) and the def before current was put = 95

0000 56198
95
280790
505172
,0053387910

Put the current one for one half minute and def = 120

,0000 56198
120
,0267 43760

Added 20 drops H_2SO_4 (making 70) and the def before current was put on = 116

,0000 56198
110
561980
56198
,0061817 80

Put current on for one minute and def = 115

,0000 56198
115
280990
56198
56198
,0064627 70

Added 30 drops acid making 100 — and def before current was put on was 126.

,0000 56198
126
337188
112396
56198
,0070809 48

Put on current for 15 minutes and def = 106

,0000 56198
106
337188
56198
,0059569 88

Put in 100 more drops acid (making 200) and def before current put on = 104

,0000 56198
104
,0059569 88 volts

Put current on three minutes
and def = 110

```
,0000 56198
        110
  561980
   56198
,0061781780 volts
```

Put in 300 drops acid (making 500)
and def before current was put
on = 95

```
,0000 56198
        95
  280990
   56198
,0053388100 volts
```

Put on current for 8 minutes
and def = 105

```
,0000 56198
        105
  280990
   56198
,0059007790 volts
```

Continued page 36

Sept 9 — 1881

I turned the connections
of two bottles and passed
a current from 1 cell through
them at 5.55 and disconnected
them at 8.30 having been on 2 hours
and 35 minutes.
The copper weighed before commencing
Bottle #3
72.99955 + 66.8512 grams.
Bottle #4
71.754175 + 70.3022 "
Afterwards they weighed
Bottle #3
71.8857 + 67.9524 grams
Bottle #4
70.6133 + 71.4035 "
The difference was

1.11385 Taken off } #3
1.1012 Deposit }

1.140875 Taken off } #4
1.1013 Deposit }

I connected them again at
9.15 P.M.

from page 34

Sept 10 — 1881

The deposition cell was allowed to stand over night with no current on and gave a def of 49.

,0000 56198
49
505982
224792
27533702

With 4 Ohms resistance
The current was then put on for 40 minutes and def was 1.15

,0000 56198
115
280990
56198
,0064627 70

Now I changed the solution I had been using which was the ordinary — containing iron — to the standard solution of pure Copper sulphate containing no acid.

The def before current was put on was 124

,0000 56198
124
224792
112396
56198
6968552 Volts

I put current on for one minute def 135

,0000 56198
135
280990
168594
56198
7586730 Volts

Then added 10 drops acid def before current was put on 120

,0000 56198
120
,0067 43760 — Volts

Put on current for 1 minute
def 135

.0000 56198
135
280990
168594
56198
.007586730 – Volts

added 10 drops (making 20)
def before current was put on
120

.0000 56198
120
.006743760 – Volts

Put on current for 1 minute
def 135

.0000 56198
135
.007586730 – Volts

Put on current for one
minute and def 140

.0000 56198
140
224792 0
56198
.007867720 Volts

.0000 56198
140
224792 0
56198
.007867720 Volts

Now I took out the four
Ohms resistance and add 20
drops acid (40) def before current
was put on 120

.0000 56198
120
.006743760 – Volts

Put current on for 1 minute
def 140

.0000 56198
140
.007867720 – Volts

Added 60 drops acid (1.09) and def before current was put on 120

,00005 6198
120
,006743760 = Volts

Put current on for 1 minute def 140

,00005 6198
140
,007867720 Volts

Added 100 drops acid (2.00) def before current was put on 120

,00005 6198
120
,006743760 Volts

Put on current for 15 minutes def 115

,00005 6198
115
,006462770 Volts

To this solution I added 25 drops of ammonia. def with no current 105

00005 6198
105
270990
56198
,005900790 Volts

Put on the current for one minute — def 130

,0000 56198
130
16859 40
56198
,007305740 Volts

Added 2 cc dilute ammonia
def with no current 103

.0000 56198
103
168594
56198
5788394

168594
56198
5788394-0

Put current on one minute def 115

.0000 56198
115
.00646 2770 – Volts

Made the solution strongly
alkali def – no current 135

.0000 56198
135
.0075-86730 – Volts

Put current on for 4.0 minutes
Electromotive very strong – threw
the spot off the scale.

Sept 10

Experiment to determine in
acid solution of
Copper Sulphate in which is
immersed two copper plates
what effect it has on the
plates. Experiment commenced
2:15 P.M.

Plates weighed

1 Without screw 63.706975

1 With screw 67.9147

44 Continued from 43

Spot on scale after about ten minutes (See top previous page) returned to 195.

Sept 10 1891 45

Disconnected bottles #3 & 4 after being connected for 11½ hours.

The copper in bottle #3 weighed
73.2217 grams
66.40065 "

The copper in bottle #4 Weighed
71.98675 grams
69.98425 "

Deposit in #3 bottle 1.336 grm
Dissolved " #3 " 1.65175 "
Deposit " #4 " 1.37345 "
Dissolved " #4 " 1.41925 "

Reconnected them again on one Ballard cell at 10.05 A.M.

Sept 10 1881

Experiment to determine the change in weight of two copper plates immersed in an acid solution of sulphate of copper (1 drop to 1 in. cm) and that circuited outside.

Commenced at 2.30 P.M.

Plate #1 with screw weighed 65,4619 grams

" #2 without " " 72,1052 "

I connected two bottles in series and passed a current from one Gallaud cell through 400 ohms resistance through them, each bottle contained about 1/5 drop of sulphuric acid. Gilbert commutator

The coppers in bottle #1 weighed

67.085 grams without screw

66.670 grams with screw

The copper in bottle #2 weighed

68.0027 grams with screw

69.2813 grams without screw

Commenced at 11.15 A.M.

continued page 49

Sept 11 1881.

Silver plated 4 copper and put them in two bottles of silver solution and passed a current through them from one Gallanid cell and 400 ohms resistence commenced at 4.40 P.M,

The weight of the copper in bottle #1 was

+ copper with screw 63.4717 g.
- " without " 70.858825 "

The copper in bottle #2 weighed

+ copper #1 74.026 grams.
- " #2 68.4382 " ,

Sept 12 1881

Disconnected bottles at 8.55 A.M, having been on 45 hours and 40 minutes (page 47)

The copper weighed

#1 Bottle

66.9888 grams with screw
66.7432 " without "

#2 Bottle

67.9018 grams with screw
69.35085 " without "

The difference in weight was as follows

#1 bottle

Deposited 73.2 mg.
Dissolved 96.2 "

#2 bottle

Deposited ~~73.2~~ 69.55 mg.
Dissolved 100.9 " ,

Sept 12th 1881

Platinum with gold plated copper.

I took four copper and gold plated them heavily and put them in three bottles of gold solution

The coppers weighed as follows

#4 Bottle

60.963075 g with long wire
60.6617 " " short wire

#8 Bottle

70.87685 g with long wire
68.88875 " " short wire

I passed a current from 1 Cell and all through them and 400 ohms resistance commenced at 8.50 P.M.

Sept 12 1881

continues from page 48

I disconnected the current at 4.30 P.M. having been on 23 hours and 50 minutes,

The coppers weighed in

Bottle #1

70.923.75 without screw
63.4117 without "

The coppers in bottle #2 weighed

74.081 gram
68.815 gram.

Sept 12 1881

The change in weight was as follows

Bottle #1

64.925 mg deposit.
60.000 " dissolved.

Bottle #2

55.7 mg deposit.
122.5 " dissolved.

Sept 12th 1881

I connected the silver plated copper in series again as before with 400 ohms resistance

The copper weighed

Bottle #1

70.92375 grams. short wire
63.4117 " long wire

Bottle #2

74.0817 grams. long wire,
68.3157 " short wire.

I commenced this experiment at 5.25 P.M.

I found one of the platinum strips had got loose and short circuited the bottle.

Sept 13 1881

continues from page 50

I disconnected the gold plated copper at 11.25 A. M. after having been connected for The coppers weighed

Bottle #8

70.8617 grams long wire

63.8957 " short wire

Bottle #4

61.9527 grams

60.6657 grams

Sept 13 1881

The difference in weight was as follows.

Bottle #8

Dissolved 15.15 mg.

Deposit 11.95 mg.

Bottle #4

Dissolve 10.375 mg.

Deposit 4.000 mg.

56 Sept 18 1881

I connected two gold plated copper again to 1 Ballard cell through 400 ohms resistance

The weight of the copper was

#4 Bottle

61.9527 Gram long wire.

60.6657 " short wire.

#8 Bottle

70.8617 Gram long wire.

63.8957 " short wire.

I connected them at 12.25 P.M.

Sept 18 1881 57

I connected the silver plated strips in series and passed a current from 1 Ballard cell through them and 400 ohms resistance.

I commenced this experiment at 5.35 P.M.

The copper weighed

#1 Bottle

63.3517 Gram long wire

70.9657 " short wire

#2 Bottle

74.0653 Gram long wire

68.3155 " short wire

Sept 14th 1881

I connected two bottles in series to 1 Gallaud cell through 400 ohms resistence. The distance between the plates was three times as far as usual and the solution contained about 3 per cent of acid

The copper weighed as follows.

#1 Bottle with wire.

68.5127 g. with screw.
71.8407 g. without screw.

#2 Bottle

67.5452 g. with screw.
63.73595 g. without screw.

I commenced this exp. at 4 P.M.

Sept 14. 1881.

I connected 2 cells in series and passed a current of 1 Gallaud cell through this and a resistence of 400 ohms

The copper weighed as follows

Bottle #1

66.99185 gram without screw
66.7536 " with screw

Bottle #2

67.907 gram with screw
69.1952 " without "

The solution contained about 10% of acid.

I commenced this experiment at 6.35 P.M.

Sept 15 1881

I made four circular plates of copper and connected them in pairs in series in a solution of sulphate of copper with about three per cent of acid.

I passed a current from one Callaud cell through them, and 400 ohms resistance.

I commenced this experiment at 4.25 P.M.

Sept 15 1881

The circular copper weighed in air.

Disk #1

42.5248 gram no screw

45.5613 " with "

Disk #2

33.9652 gram no screw

37.1126 " with screw

62

Sept 15 1881

Experiment with plates to determine what kind of a deposit can be obtained.

I took two zinc plates and amalgamated them well. And immersed them in a neutral solution of sulphate of zinc (saturated).

I passed a current through them and 400 ohms resistance from one Calland cell.

I commenced this at 1.30 P. M.

Sept 16 1881

63

Experiment with zinc plates.

I took two bottles of saturated solution of sulphate of zinc, and put two zinc plates (amalgamated) in each.

The zinc plates weighed

Bottle #1.

in air	in water
85.2772 g	73.5304 g no current
86.1655 "	73.43295 " with "

Bottle #2.

86.0835 g	74.239 g no "
85.81605 "	74.0032 " with "

I commenced this experiment at 11.35 A M.

One Calland cell through 400 ohms resistance.

64 Sept 16 1881

continued from page 48.

I weighed the copper plates which weighed as follows,

#1 with screw 67.9922 gram.
#2 without " 68.7077 "

The difference in weight was as follows

#1 with screw 10.3 mg.
#2 without " 20.025 " "

20 Ohms

Sept 16 1881. 65

Experiment with zinc plates

I took two zinc plates and immersed them in a neutral saturated solution of sulphate of zinc.

The plates were accurately weighed as follows

	in water	in air
#1	75.0292 g.	87.007 g. with screw
#2	74.1755 g.	86.044 " no "

I close circuited the plates at 10.85 A. M.

Sept 16 1881

I connected two bottles with copper plates separated three times as far as usual, with 10 % acid.

The coppers weighed in water

Bottle #1 (with wires)

68. 58775 grams with screw

71. 7491 " without screw

Bottles #2

67. 5923 grams with screw.

63. 6962 " without " ,

I commenced this exp. at 1 P.M.

I connected to one battery all through 400 ohms resistance

Sept 16 1881

Experiment with zinc plates immersed in a saturated solution of sulphate of zinc and left alone to see if the weight changes.

The zincs weighed as follows,

in air in water

89. 89115 g. 78. 266 with screw

90. 70089 g. 78. 96485 without ,

I commenced this exp at 8.40 P.M.

Sept 16 1887

continued from page 58.

I disconnected the bottles at 11.30 A. M.

The copper weighed as follows.

#1 Bottle with wire
68.58775 g. with screw,
71.7491 g. without " .

#2 Bottle
67.5923 g. with screw.
63.6962 g. without " .

Sept 16 1887

The change in weight was as follows.

#1 Bottle.
75.05 mg deposit
91.6 " dissolved

#2 Bottle.
47.1 mg deposit.
39.75 " dissolved.

Sept 16 1881

I connected two bottles in series and passed a current from one cell through them and 400 ohms resistance. The solution was about 10% acid and the plates separated three times as far as usual.

The copper weighed

#1 Bottle (with wire)
68.58775 gram with screw
71.7491 " without "

#2 Bottle
67.5923 g. with screw.
63.6962 " without " "

Commenced at 1 P.M.

Sept 17 1881

continued from page 46

I discommected the copper at 8.25 P.M.

They weighed as follows

72.0433 gram. without screw
65.4873 " with screw

The difference in weight was as follows.

6.2 my dissolved.
35.6 " deposit.

Sept 17 1881

Experiment with nickel plates.

I nickel plated 4 copper and put them in two bottles in series, containing a neutral solution of sulphate of ammonia and nickel.

I passed a current from one cell through them and 400 ohms resistance.

I commenced this experiment at 1.25 P.M.

Sept 17 1881

The nickel plated copper weighed as follows

Bottle #1

in air	in water	
79.7281 grams	70.7762	no current
79.6947 "	70.7855	with "

Bottle #3

in air	in water	
80.8652 grams	71.33495	no current
84.739 "	75.209	with "

Sept 17, 1881

continued from page 69

I discommuted the coppers at 1.15 P.M.

The plates weighed as follows.

Bottle #1

66.8977 gram with scum

66.8022 " without "

Bottle #2

69.856 gram without "

67.7202 " with "

Sept 17, 1881

The change in weight was as follows.

144.1 mg deposit. } #1
189.15 " dissolved }

160. mg deposit } #2
186.8 " dissolved }

Sept 17 1887

continued from page 63.

I disconnected the zinc plates at 3.40 P.M.

They weighed as follows

Bottle #1

in air	in water	
85.291 gram	73.530 25	with screw
86.190 "	73.427 8	without "

Bottle #2

in air	in water	
85.988 gram	74.109.9	with screw
85.9575 "	74.131 2	without "

The change in weight was

105.5 mg deposit } #1
107.2 " dissolved }

101.95 mg deposit } #2
106 " dissolved }

Sept 17 1887

I connected two bottles in series with zinc plates and passed a current through them and 200 ohm from 1 cell.

I commenced this at 4.15 P.M.

The zincs weighed as on preceding page.

78 Sept Sunday 18/1881

Zinc plating experiment

two plates put in Zinc Sulphate.

Plate No 1

89.950 before current on

90.916 after " "

No 2

89 866.8 before current on

90.9128 after " "

Here two deposit cells 79
with Zinc Plates were united
in the solution of Zinc sulphate
thus connecting to a domestic
cell.

I disconnected these
plates at 9.15 A.M. Sept 20/81

The deposit was as
follows.

#1 2.966 mg

#2 3.046 mg

Dept 19. 1881

Sprague Chemistry p 292 says Zinc Sulph. is soluble in 2½ parts cold and also quantity of boiling water.

Took #5 bottles with 100 cc distilled water in each put in

No	1	—	40	grams	Zinc sulphate
"	2	—	39	"	"
"	3		38	"	"
"	4		37	"	"
"	5		36	"	"

(Retort weighs 50.103 grams) Left these bottles over night and in the morning warmed slightly to complete solution. Reduced to 0° C. and found No 1 held all the salt in solution.

Took six bottles put in

No. 1	42	grams	Zinc sulphate	100 cc water
" 2	44	"	"	"
" 3	46	"	"	"
" 4	48	"	"	"
" 5	50	"	"	"
" 6	75	"	"	125 "

(Commercial Zinc sulphate and distilled water used)

Dissolved the salt in each of these bottles and then put in ice for 18½ hours. Put in a little salt ($NaCl$) with the ice. When taken out they were a little below 0°C. No six held all the salt in solution. Put back into ice to stay over night. Also #

#7 - 100 grams Zn sulphate 125 cc water

#8 - 75 " " 100 "

Sept 21

This morning took the 8 bottles out of the ice and found #7 had all the salt in solution.

Put in six bottles 100 cc water in each. Into #1 85 grams zinc sulphate

2	90	"	"
3	95	"	"
4	100	"	"
5	105	"	"
6	125	"	"

Put these bottles into the ice for two hours and found #6 had deposited a very small quantity of crystals - perhaps 10 m grams all the others held all the salt in solution.

Took a small metre bottle with Zinc sulphate solution 100 parts water to 100 parts Zinc sulphate. Amalgamated Zinc plates. Reduced the temperature to

Sept 19 1881

continued from page 61

I disconnected the circular plates at 10.15 A.M.

They weighed as follows

#1

42.1895 gram no screw

45.7521 " with screw

#2

33.6166 gram no screw

37.3018 " with screw

The difference was

#1

235.3 mg ~~deposit~~ dissolved.

190.8 " deposit.

#2

248.6 mg dissolved.

189.2 " deposit.

Sept 19 1881

Experiment with zinc plates.

I connected two bottles in series and passed a current from 1 cell thro thin and 400 ohms resistence at 6.00 P.M.

The zincs weighed

Bottle #1

in water	in air	
78.6338 g	90.2345	no screw
78.6746 g	90.233	with "

Bottle #2.

in water	in air	
77.1623 g	88.5032 g	with screw
80.0122 g	91.800 g	without "

Sept 30 1881

Experiment with lead plates.

I took 4 lead plates and amalgamated them, and put them in two bottles in series, and passed a current from 1 cell through them and 400 ohms resistence. The plates weighed as follows.

Bottle #1

63.185 grains

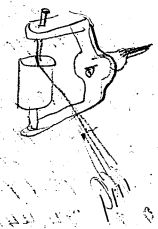
64.7867 "

Bottle #2

62.3485 grains

62.87775 "

I commenced this experiment at 3.10 P.M.



Sept 20 1881

(continued from page 77)

I disconnected the copper zincs at 2.10 P.M.

They weighed as follows

Bottle #1

in air	in water	
84.7886 g	73.0718	no screw
85.7005 g	73.8681	with screw

Bottle #2

in air	in water	
85.557 g.	73.774.2	no screw
86.340 g.	74.441.2	with "

The change in weight was

Bottle #1

408.5 mgs deposited
402 mg dissolved

#2

402 mg deposit
400.5 mg dissolve

Sept 21 1881 87

continued from page 79,

I disconnected nickel plates at 9.10 A.m.

They weighed as follows

Bottle #1

in air	in water	
79.7312 g	70.777.9	no screw
79.6314 g	70.7068	with "

Bottle #3

in air	in water	
84.7155 g	75.2732 g	with screw
80.3636 g	71.3432 g	no "

The difference in weight was as follows.

3.1 mg deposit
63.8 " dissolved
} #1

1.6 mg dissolved
23.5 " dissolved
} #3

Sept 01 1881

I took two meters #1 & 2 and connected them in series on two Calland cells in series. Each meter had only one bottle (monthly) which had zinc plates, amalgamated immersed in a solution of sulphate of zinc.

Sept 01 1881

The zinc plates weighed as follows,

Bottle #1,

in air	in water	
90.5185 g	78.8767	with screw
90.5181 g	78.8567	no screw

Bottle #2

in air	in water	
89.8766 g	78.3282	with screw
91.3741 g	79.6182	no screw

I commenced this experiment at 2.30 P.M.

2.8

1.065
1.102
2 130
1065
1086

1.098

H=32

9.96
11.09

from page 81

15.

below freezing point and measured the resistance at different temperatures with the Thompson low resistance Galv. as follows (Leading wires out)

32° F.	2,18 Ohms	
"	1,88	
"	1.78	
"	1,68	
32	1,58 = 1.44 ohms	
34	1.53	
35	1.52	
36	1.45	
37	1,44	
38	1.43	
39	1.45	
40	1.33	
41	1.31	
42	1.29	
43	1.28	
44	1.26	
45	1.24	
46	1.23	
47	1.21	
48	1.18 (32)	
49	1.15	
50	1.13	
51	1.11	
52	1,10	
53	1.08	
54	1.05	
55	1.03	
56	1.02	
57	1.00	
58	.98	

Plates 1/4 inch apart

59° F.	.97 Ohms
62	.94
63	.94
64	.92
65	.91
66	.90
67	.89
68	.88
69	.87
70	.86
71	.85
72	.84
73	.83
74	.82
75	.81
77	.80
79	.79
80	.78
82	.77
83	.76
84	.75
85	.73
86	.71
88	.70
89	.69
90	.68
91	.66
92	.65
93	.63
94° F.	.64 Ohms
95	.63
97	.62
98	.60
100	.59
115	.58

Sept 22 1881

Tested the resistance of solution of sulphate of zinc in a metz bottle between plates 1/8 inch apart

at 40° F. = .66 ohms
" 45° F. = .61 ohms
" 47° F. = .58 ohms
" 54° F. = .49 ohms

Sept 22 1881

Experiment with cadmium sticks.

I took 4 sticks of cadmium in two bottles of sulphate of cadmium and connected them to one cell with 400 ohms resistance

I commenced the experiment at 11,50 a.m.

Sept 22 1881

The cadmium sticks weighed as follows

Bottle #1

104,4211 grams

106,7749 "

Bottle #2

99,5134 grams

102,478 grams

Sept 28 1887

I regulated the resistance of the spools of two meters to .66 ohms at 400 F.

I connected the two meters in series to ten Gallard Celle in multiple arc. The meters had zinc plates separated 1/8 inch apart.

Sept 28 1887

The zinc plates weighed as follows,

#1 Meter

Monthly Bottle

86.2284 grams with screw
85.5511 grams no screw

Yearly Bottle

86.6295 grams with screw
84.7516 grams without screw

#2 Meter

Monthly Bottle

88.6852 grams with screw
90.620 " without "

Yearly Bottle

87.2237 grams with screw
92.6756 " without "

Sept 24 1881

I adjusted the resistance of the meter spools to 1.45 ohms each at 84°

I connected two meters in series to 10 cells in multiple arc at 6.30 P.M.

The zincs were 1/4 of an inch apart.

The zincs weighed as follows

#1 Meter

Monthly Bottle

91.8682 grams no scum

90.782 " with "

Yearly Bottle

90.1292 grams. no scum

89.873 " with "

Sept 24. 1881

#2. Mates

Monthly bottle

91.5209 grams no screw

88.4011 grams with screw

Yearly bottle

90.6161 grams no screw

90.0112 grams with "

Sept 27 1881

Experiment with zinc plates separated at different distances

I took three bottles of chemically pure sulphate of zinc and in each bottle I put a pair of zinc plates separated as follows.

#1 1/25 inch

#2 1/8 inch

#3 1/2 inch

I connected ~~the~~ bot the in series to three cells in series at 5.10 P.M.

Sept 6th 1881

I filled the meter bottles with chemically pure sulphate of zinc and connected the two meters in series to 10 Daniell cells in multiple arc.

This experiment was commenced at 9.55 P. M.

Sept 6th 1881

#1 Meter

Monthly Bottle

90.5396 grams. weight

91.006 grams. " zinc

Yearly bottle

88.0187 grams weight zinc

89.6963 grams " zinc

104

Sept 27 1887

#2 Mitis

Monthly Bottle

89.9561 grams with sediment

90.740 grams no sediment

Yearly bottle

88.4007 grams with sediment

90.154 grams no sediment

Sept 28 1887 105

I disconnected the meters at 11.40 A. M., having been on 19¾ hours. The solution was clear in all the bottles and the deposit was opulent.

Sept 28 1881

The zinc plates weighed

1 Meter

Monthly bottle

91.0928 grams with screw

90.4720 grams without screw

2 Meter

Monthly bottle

90.540 grams with screw

90.183 grams without screw

Sept 28 1881

1 Meter

Yearly bottle

~~#~~

88.1468 grams with screw

89.5684 grams no screw

2 Meter

Yearly bottle

90.2815 grams no screw

88.2625 grams with screw

Sept. 28 1881

The difference in weight was as follows

#1 Meter

Monthly Bottle

553.2 mg. deposit
534.0 mg. dissolve

Yearly Bottle

168.1 mg deposit
127.9 mg dissolve

#2 Meter

Monthly bottle

588.9 mg deposit
567 mg. dissolve

Yearly bottle

127.5 mg deposit
138.2 " dissolve

Sept 28 1881

I set the meters going again as before at 1.16 P. M.

The zincs weighed as on page 106 & 107

The plates to be deposited on were the same as had been dissolved before.

I did not amalgamate the zincs again

Sept 28 1881

I took two zinc plates separated half an inch and passed a current from 5 Gallond cell in series through them to see what kind of a deposit is obtained with a strong current

Commenced at 8.15 P. M.

Sept 28. 1881

This morning the deposit was black and loose and much at the bottom

Sept 29 1881

I disconnected the meters at 10.30 A. M.

The deposit on the plates in monthly bottles was quite loose

That in the yearly bottles was better but not very adherent so that the weight could not be obtained

September 29 1881

The plates which were dissolved from weighed as follows.

#1 Meter

Monthly bottle

90.1480 grams

Yearly bottle

88.~~1776~~.0046 grams

#2 Meter

Monthly bottle

89.9258 grams

90.1417 grams.

Sept 29 1881

The weight of zinc dissolved was as follows

#1 Monthly

612.8 mg

Difference 1.4 mg.

#2 Monthly

614.2 mg

~~#1 Monthly~~ Yearly

142.2 mg

Difference 2.4 mg.

#2 Yearly

139.8 mg

Sept 29 1881

continued from pag 101

The deposit in all the bottles was loose and black and some of it had fallen to the bottom of the bottle

Evidently the current was too strong.

Sept 30 1881

I coated the zincs with an amalgam of mercury and zinc by rubbing with zinc and then amalgaming and plating again and so on.

I set the meter going again with the zincs prepared as above.

I connected the meter at 6,00 P.M.

Sept 30 1881

The gauges weighs as follows:

#1 Meter

Monthly bottle

97.6845 grams with screw

90.8063 " without "

Yearly bottle

92.3410 grams with screw

92.8661 " without "

Sept 30 1881

#2 Meter

Monthly bottle

92.2785 grams with screw

94.0096 " without "

Yearly bottle

90.6362 grams with screw

92.8852 " without "

Oct 3d 1881

Amalgamated the cadmium stick, and immersed in a solution of cadmic sulphate,

Connected them to one Gallaud cell and 400 ohms resistance.

Commenced this experiment at 10.00 A.M.

Oct 3d 1881

The cadmium sticks weighed as follows

#1,

104,146 grams,

#2.

106,650 grams,

#3

99,2968 grams,

#4

108,4727 grams,

Oct 8 1881
continued from p. 119

I disconnected the meter at 1.56 P.M.

The deposit in the monthly bottles was not very adherent and that in the yearly bottles though better was still not very good.

Oct 8 1881

The gains weighed as follows.

#1 Metis

Monthly bottle

91.7864 grams, no sum

90.4316 " with "

#2 Metis

Monthly bottle

94.7736 grams no sum

91.5683 " with "

Oct 3d 1887

#1 Meter

Yearly bottle

92,1601 grams with sediment

93,0705 " no "

#2 Meter

Yearly bottle

93,1012 grams no sediment

90,4163 grams with "

Oct 3 1887

The difference in weight was as follows.

#1 Meter

Monthly bottle

910.1 mg Deposit

1353 mg Dissolved

#2 Meter

Monthly bottle

764 mg Deposit

708 mg Dissolved

#1 Meter

Yearly bottle

177.9 mg Deposit

1841.5 mg Dissolved.

#2 Meter

Yearly bottle

216 mg Deposit

2199 mg Dissolved

Oct 3rd 1887

I filled off the deposit and reamalgamated the pieces, and commuted them again to the 10 cells of battery.

I commenced this experiment at 6.15 P.M.

Oct 3 1887

The zinc weighed as follows.

#1 Plates

Monthly bottle

88.6091 grams no screw

88.4105 grams with screw

Yearly bottle

90.0846 grams no screw

88.7577 grams with screw

Oct 3 1881

2 Meter

Monthly battle

88,161 grams no screen

89,845 grams with "

Yearly battle

91,5218 grams no screen

90,4139 grams with "

Oct 4th 1881 127

I disconnected the meters at 3.10 P.M

The deposit was good on all the plates,

The deposit was small as the batteries were nearly run down,

Oct 4 1881

The plates weighed as follows.

#1 Mitis

Monthly bottle

88.733 grams with screw

88.3161 " no screw

Yearly bottle

88.6895 grams with screw

90.3577 " no screw

Oct 4 1881

#2 Mitis

Monthly bottle

88.4765 grams no screw

89.5411 " with screw

Yearly bottle

91.6025 grams. no screw

90.353 " with screw

Oct 4th 1881

The change in weight was as follows,

#1 Meter

Monthly bottle

308. my Deposit.

293 my Dissolved.

Yearly bottle

73.1 my Deposit.

74.2 my Dissolved.

#2 Meter

Monthly bottle

315.5 my Deposit.

303.9 my Dissolved.

Yearly bottle

70.7 my Deposit.

60.9 my Dissolved.

Oct 4th 1881

I connected the meter again the same as before.

The battaries being almost exhausted I put in more blue vitriol.

I commenced this experiment at 4,35 P.M.

For weights see pages 129 & 130.

Oct 6 th 1881

(continued from page 119.

Disconnected the cadmium at 4.30 P.M.

They weighed as follows.

#1

103.909.1 grams.

#2

106.945 grams.

#3

99.020 grams.

#4

103.7649 grams.

Oct 6 th 1881

The difference was as follows.

#1.

236.9 mg. Dissolved

#2.

~~106~~ 295 mg Deposit

#3.

276.8 mg Dissolved

#4

292.2 mg Deposit.

Oct 8th 1881

I connected the cadmium plates again at 6 00 P.M. exactly the same as before

Oct 8th 1881

continued from page 134

I disconnected the zinc cadmium plates at 11 00 A.M. They weighed as follows

#1

103, 6485 gram

#2

107. 3005 gram

#3

98, 7705 gram

#4

104. 1175 gram

136 Oct 8 & 9 1881

The difference in weight was as follows.

#1

366.6 mg Dissolve

355.5 mg Deposit

#3

349.5 mg Dissolve

#4

352.6 mg Deposit

Oct 8 & 9

137

Continued from page 65

I discontinued the current at 1.00 P.M. 33 days. They weighed as follows

86.9445 grams no screen

86.9478 " with screen

The difference was as follows

99 mg less

86 mg less

The plates were ~~[illegible]~~ slightly covered with a dark covering which rubbed off leaving them bright.

Oct 10th 1887

continued from page 104

I disconnected the [illegible] line at 12.00 M,

The deposit in the monthly bottles was rather loose.

Oct 10th 1887

The grains weighed as follows.

#1 Meter

Monthly bottle

86.106 grains no urine

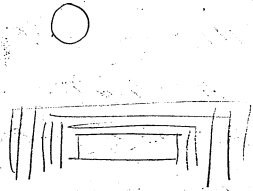
90.9174 " with "

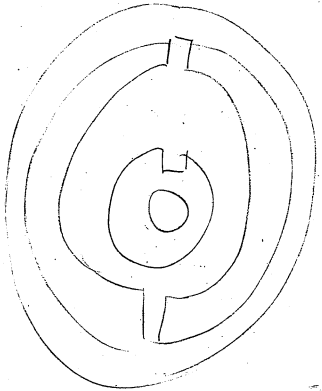
#2 Meter

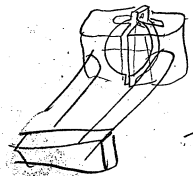
" Monthly bottle

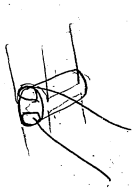
90.4406 grains no urine

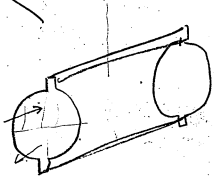
87.7784 " with "

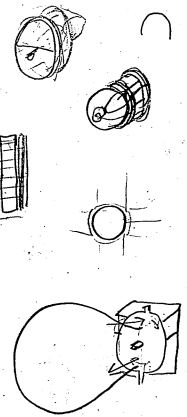


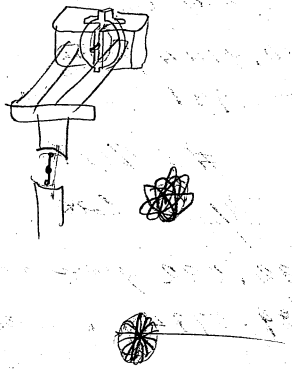












Oct 10th 1881

#1 Meter

Yearly bottle

90.9144 gram no screen

88.1931 " with screen

#2 Meter

Yearly bottle

92.282 gram no screen

89.8794 " with screen

Oct 10th 1881

The difference in weight was as follows

#1 Monthly

3.1844 gram Deposit

~~1.9641~~

2.2101 " Dissolved

#2 Monthly

1.9641 gram Deposit

1.7471 " Dissolved

#1 Yearly

556.7 mg Deposit

490.4 " Dissolved

#2 Yearly

629.5 mg Deposit

473.6 " Dissolved

Oct 10th 1881

Experiment with zinc plates immersed in S. R. sulphate of zinc and shot inserted to see if the weight changes.

The zincs weighed as follows,

86.830 grams with screw

86.0461 " without "

Commenced at 3.30 P. M.

Oct 11th 1881

continued from page 67

The zincs weighed as follows

89.8561 gram with screw

90.660 " without screw

The difference was as follows

85.05 mg less with screw

40.8 mg less no screw

These zincs were left in for 25 days.

Oct 19 to 1881

Experiment with zinc plate immersed in a solution of chemically pure sulphate of zinc and left alone to see if the weight changes.

The zinc plate weighs as follows.

90.7472 grams no screw

89.7337 grams with screw.

Commenced this experiment at 9.30 A.M.

Meter Experiments

Oct 18 1881

Made 10 shunts each having a resistance of .01078 ohms. Also 10 small shunts each having a resistance of .00269 ohms at 85° F. this is good

Also made 20 spools of copper resistance for compensating. this resistance is 3 ohms at 0°C. at about 60 it was or was measured off at 3.19 ohms.

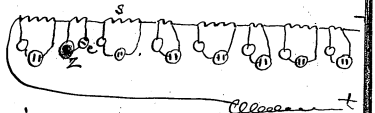
Had some C.P. solution of sulphate of zinc and put in each of the 20

1.079
14
8632
1079
19.422 volts
116.2
38844
11653
19422
81.46364 volts on the res

1.675) 81.46364 (18.78
1675
14713
13400
13136
11725
14114
13400

bottles 12 4 C.M of the solution. This solution is of the strength 1 to 1 Pound of sulphate of zinc to 1 Pound of water.

had all these shunts arranged in series and in circuit with some resistance. like fig.



Resistance with leading wires 1.7006 ohms
.025
1.6756 ohms at 15°C

Put the current on at at 10.15 Oct 14 1881. on all the plates stop at 11.15 so had it run just one hour.

315/710) deflect from the terminals of the 1.675 ohms.

191/198) deflection from BB'

2(384)
192 315/810
2(625)
192 618/192 (1.62
1200
1152
480

see page 154

Coil C

	weight	
# 13		
without screw	80.522.2	leaving plate last 616.6 mg.
with screw	82.782.1	
with 2 screws	79 905.6	
with 4 screws	83.433.7	deposited plate had a deposit of 651.6 mg.

80.522.2
79 905.6
616.6

83 433 7
82.782 1
651.6

without screw 80.00276
with screw 82.6982
without screw
with screw

158

"cell = D"

#17

without screw	81.242,7		dissolved 122.7
with screw	82. 85.6		
without screw	81. 120		
with screw	82 24685		deposit 161.25
81.242.7	82246.85		
81 120	82085.6		
122.7	161.25		

without screw 81.2431
with screw 82.3001
without screw
with screw

159

"cell "C"

#16

without screw	80,560.7		dissolved 629.2 mg
with screw	82,446.6		
without screw	79. 931. 5		deposit 667. mg
with screw	83 111 6		
80 5607	83 1116		
79 931.5	82 4466		
629 2	6670		

without screw 79.8051
with screw 83.53055
without screw
with screw

"F"

#15

without screw 81.178
with screw 81.926.2
without screw 81.058.5
with screw 82.077.5

81 173
81 058.5
82 077.5
81 926.2
1.513

dissolved
114.45 Mg
deposit
~~150~~ 151.3

82 07.5
81 11.45
9045

without screw 80,920
with screw 81.701
without screw
with screw

"G"

#14

without screw 80,947.95
with screw 81,355
without screw 80.3382
with screw 82.0141

Dissolved
614.75
Deposit
659.1

without screw 80,0512
with screw 82,1755
without screw
with screw

#12 "N" "

without screw 81.223.5
with screw 82,340
without screw 81,105
with screw 82,4918

Deposited 118.5
Deposit 151.8

without screw 80.980
with screw 82,0565
without screw
with screw

#11 "J" "

without screw 82.142,5
with screw 83,382.1
without screw 81,5115
with screw 84.0473

Deposited 631,
Deposit 666,3

without screw 81.5569
with screw 84,2782
without screw
with screw

#10 " J "

without screw 82.4641.3 with " screw 83.4201.5	Diameter 117,8
without screw 82.3465 with screw 83.5711	Deposit 150,6

without screw 82,3381
with screw 83,2132
without screw
with screw

#9 " K "

without screw 88.962.8 with " screw 88,287.3	Diameter 604,3
without screw 81, 338.5 with screw 83,90305	Deposit 666,75

without screw 81,2574
with screw 83,9741
without screw
with screw

#8 "L"

without screw 82,153.9 } Dissolve 120.55
with screw 82,950.35 }
without screw 82,033.35 } Deposit 164.15
with screw 83,1045 }

~~with screw~~
~~without~~

without screw 81,5763
with screw 82,910
without screw
with screw

#7 "M"

with out screw 89,045.05 } Dissolve 694.35
with screw 90,944.1 }
without screw 88,4507 } Deposit 616.8
with screw 91,5609 }

This spool had some sulphate of zinc spilled on it

without screw 88,4968
with screw 91.6947
without screw
with screw

168

#6 "N" "

without screen 81.779.6 | Dissolve 116,05
with screen 83,260 |
without screen 81,66355 | Dl point 132,4
with screen 83,3924 |

without screen 80,8968
with screen 83,2468
without screen
with screen

169

#5 "O" "

without screen 82,580 | Dissolve 637,8
with screen 83,17512 |
without screen 81.942 | Dl point 660,8
with screen 83,836 |

without screen 81,961
with screen 84,0846
without screen
with screen

#4 "Q"

170

without screw	91.528.8	Dissolve,
with screw	89,6532	9&2
without screw	91.4366	Deposit.
with screw	89,7434	90.2

without screw 89,8451
with screw 86,8476
without screw
with screw

#3 "Q"

171

without screw	82,275.	Dissolve
with screw	83,491.8	615.15
without screw	81,65985	Deposit
with screw	84,137.9	646.1

without screw 79,8488
with screw 83,9675
without screw
with screw

Took the above plates out and put the following plates in
without screw 78.513.1
with screw 89,027

I put ammonia in the zinc cell Plate and strong to dissolve the precipitates and put the plates in this.

#2 "R"

without screw	81.201.35	Wavelength 112.8
with screw	89,579	
without screw	81,18855	Wavelength 116.1
with screw	89.6951	
without screw	81,0971	
with screw	89,4868	
without screw		
with screw		

#1 "Q"

without screw 91,497.2
with screw 89.842,5
without screw 90,9609
with screw 90,4737

Lluidas 576,3
Deposit 591,2

without screw 90,8165
with screw 90,2689
without screw
with screw

"O"

without screw 88,705,9
with screw 83 675,2
without screw 83,589
with screw 83,82495

Lluidas 116,9
Deposit 149,3

without screw 83,28285
with screw 83,7179
without screw
with screw

u

without screw 82,513,2
with screw 83 385,6
without screw 81,864
with screw 84,0133

Division 648,7
Deposit 677,7

without screw 81,9363
with screw 84,2057
without screw
with screw

v

without screw 78,329,15
with screw 82 195,1
without screw 78,20445
with screw 82,657

Division 184,7
Deposit 162,1

without screw 76,614
with screw 81,505
without screw
with screw

178

see page 156

Oct 14 1881

Started again at 11:31
Stopped at 11.51

11.51
11.31
.20

Raw or rather the current worked so far for 1:20 hr

Started again 12.42
Stop at 2.15
Started at 2.26
Stop at 5.20

1:20
1.33
2.53
2.54
5.07

12.42
1.02
2.34
2.54

33

got the conductivity of copper

179

1.20 51 / 11.31 / 20

Raw so far 5.07 mute
Started at 9.15
Stop at 12.00
9.15
2.45

5.07
2.45
7.52 hrs so far

Started at 1.10 again
Stopped at 4.30

Oct 17 1881

The change in weight was as follows on the long shunts.

Bottle.	Deposit.	Dissolved.
C.	651.6.	616,6
E.	667	629.2
G.	659.1	614.75
I.	665.3	631
K.	666.75	624.3
+ M.	616.8	694.35
O.	660.8	637.8
Q.	646.1	615.15
S.	591.2	576.3
W.	677.7	648.7

+ This spool had some sulphate of zinc spilled on it.

Oct 17 1881

The change in weight was as follows on the short shunts

Bottle.	Deposit.	Dissolved.
D.	161.25	122.7
F.	151.3	114.45
H.	151.8	118.5
J.	150.6	117.8
L.	154.15	120.55
N.	132.4	116.05
P.	90.2	92.2
R.	116.1	112.8
T.	149.3	116.9
V.	162.1	124.7

182 Oct 16th 1881

Connected three meters in series to 10 Gallons cells in multiple arc.

The meters had electrolytic zincs.

Disconnected them at 4, 6½ P.M.

183 Oct 15 1881

The zincs weighed as follows,

#1 Monday

87.29376 g. no screw.

79.3707 g. with screw.

#1 Friday

95.5306 g. no screw.

77.6527 g. with screw.

Oct 16 1881

#2 Nitro

Monthly bottle

86.0408 g no screw

86.0205 g with "

Yearly bottle

88.0593 g. no screw

86.9343 g. with screw

Oct 17 1881

Connected meters again at 5.45 P.M.

186 Started the meters C to L at 4.6 PM. oct 19 1911 the solution is the ammonium one.

80.9454
80 4952
4502

oct 19 1911 C ammonium solution

without screw	80, 945,4 187
with screw	81, 890.7
current on	
without screw	80 495.2
with screw	
Deposit	
Dissolve	450. 2

79 318 6
79 214 9
——————
1037
83 792 8
83 698
——————
94 8

D. am Solution

without screw	79.318,6
with screw	83 698
Current on	
without screw	79.214.9
with screw	83,792,8
Deposit	94,8
Dissolve	103.7

80.1508
79.7002
4506

without screw	80.1508
with screw	80,803,2
current on	
without screw	79.7002
with screw	
Deposit	
Dissolve	450.6

79 295 2
79 196 9
98.3

82 629 5
82 540 8
87.7

without screw	79.295.2
with screw	82,540,8
Current on	
without screw	79.196.9
with screw	82.629.5
Deposit	87.7
Dissolve	98.3

79,673.1
79.229

444.1

without screw	79,673.1
with screw	84,209.3
current on	
without screw	79.229
with screw	84 650.
Deposit	
Dissolve	444.1

80 573 5
80 474.1
994

82 323 1
82 224
991

without screw	80,573.5
with screw	82,224,
Current on	
without screw	80 474 1
with screw	82 323 1
Deposit	99.1
Dissolve	99.4

80,288.1
79835
4426

85023
84547
4476

J

without screw	80,288.1
with screw	84,547.6
current on	
without screw	79835
with screw	85023
Deposit	4547
Dissolve	4426

$2.4762
$1.5953
.8809

$1.5953
$1.4989
.0964

$2.4762
$2.380
.0962

without screw	$1.595,3
with ... screw	$2.380
Current on	
without screws	$1.4989
with screws	$2.4762
Deposit	96.2
Dissolve	96.[illegible]09

80 8888
80 4436
4452

K.

without screw	80.888.8
with screw	¥2,735,3
current on	
without screws	80 4436
with screws	
Deposit	
Dissolve	4452

80884.5
80786.8
97.7
84.4621
84.3649
97.2

L'

without screws	80,884.5
with screws	84.364.9
current on	
without screws	80.786.8
with screws	84 4621
Deposit	97.2
Dissolve	~~75~~ 97.7

Summary

	Deposit	Dissolve
(1) "C"		450.2
(2) "D"	94.8	103.7
(3) "E"		450.6
(4) "F"	88.7	98.3
(5) "G"		444.1
(6) "H"	99.1	99.4
(7) "I"	454.7	442.6
(8) "J"	96.2	96.4
(9) "K"		445.2
(10) "L"	97.2	97.7
Remarks		

Experiment of 19 1881

to determine if there is any loss ~~of the~~ weight when the plates are in the solution open circuit.

Without screw	76.592
With screw	81.450
Plates put in solution	
Without screw	
With screw	
Loss	
Gain	

Oct 19 1881

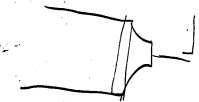
Experment 209

to determine if there is any loss of ~~wta~~ weight in the plates when short circuited on itself.

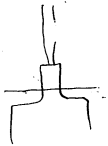
without screw	81.5459
with screw	84.8482
~~plates put in solution~~	
without screw	
with screw	
Lost	
Gain	

80 572 9
80 171 2
401 8

83 706 6
83 308 5
398 1



Without screw	80 572 9
With screw	83 308 5
Current on	
Without screw	80.171.2
With screw	83 706.6
Deposit	398.1
Dissolve	401.7



79.0434
78954
0894

83562
83513.7
725

Without screw	79.0434
With screw	83.513.7
Current on	
Without screw	78954
With screw	83562
~~Deposit~~	~~0894~~ 72.5
Dissolve	89.4

$ 4585
80 0126
4459

82 7121
82 2845
4276

Without screw	80,458,5
With screw	82,284,5
Issued To	
Without screw	80 0126
With screw	82 7121
Deposit	4276
Dissolve	445.9

79 758 3
79 661 8
965
81 111 7
87 5

7

Without screw	79.758.3
With screw	81.111.7
Cancelled	
Without screw	79 661 8
With screw	81 199.2
Deposit	87.5
Discharge	96 5

79 3836
79 0026
3810
83 0307
82 6600
3707

Oct 23

Without screw	79.3836
With screw	82.6600
Excess on	
Without screw	79.0026
With screw	83.0307
Deposit	370.7
Disscolve	3810

80 2545
80 1679
866

82 2682
82 1871
811

Without screw	80.2545
With screw	82,187.1
Fragment on	
Without screw	801679
With screw	82682
Deposit	81,1
Dissolve	86 6

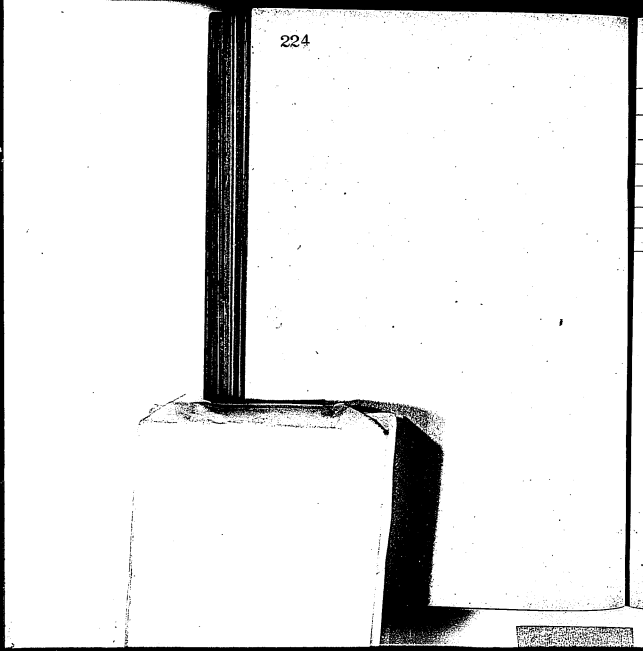
50 4234
79 9865
4369

85 1357
54 6927
4430

I

Without screw	79.986.5
With screw	85,135,7
Current on	
Without screw	50 4234
With screw	84 6927
Dissolve	443 0
Deposit	4369

Without screw	T9.253.4
With screw	X4.664.
Current on	
Without screw	
With screw	
Lehozit	
Lissowine	



K

Without screw	$1.37C.9
With screw	$2.370.1
Current coil	
Without screw	
With screw	
Deposit	
Dissolver	

Without screw	80,570,8
With screw	84,451,2
Erased on	
Without screw	
With screw	
Deposit	
Dissolve	

Summary of deposit 398.1 dissolve 401.7

Oct 23

This One was short circuited on itself

without screw	X0 936.7
with screw	89.081.3

79 28 61
78 79 82

4879

Oct 23, The following six all were put in current with one 233 battery and 10 ohms

without screen	78,798,2
with screen	83,103,5
without screen	79 2861
with screen	82 6233
	487.9

79 3712
78 8726
4986

84 731
84 2433
4897

without screen	78,872.6
with screen	84,731.
without screen	79 3712
with screen	84 2433

80 8 9 0 5
80 8 9 9 5
4910

84 2 8 3 8
83 7 5 1 6
5022

(without zeros)	80,899.5
(with) zeros	84,283.8
without zeros	80 8 9 0 5
(with) zeros	83 7 5 1 6
deposit	491.0
dissolve	502.2

80 9623
80 4695
4928

84 4435
83 9584
4851

W

~~without screw~~	80,469.5
~~With screw~~	84,443.5
~~without screw~~	80 962.3
~~With Screw~~	83 9584
~~depart~~	4928
~~dissolve~~	4851

80425
79941.4
4844

83591
83 937
4973 4

83591.
831028
4882

80425
79941.4
4846

80435
79941.4
4943

R

without zero	79,941,4
~~with~~ zero	83,591.
machine form	80425
with zero	83 0937
deposit	494.4
drawer	488 3

81 283 3
80 791 3
492 0

84 755
84 2719
4831

without screw	80.791.3
with Screw	84 755
without screw	81 283.3
with Screw	84 2719
depoit	492.
dissolve	4831

49
2
98

N Oct 23 1851

Without Screw	90.299 6
With Screw	90.550.
Current on	
Without Screw	90 0095
With Screw	90 7453
Deposit	195
Dissolve	204 6

90 299 6
90 95
204 6

90 745 3
90 550.
195 3

R Oct 23 1851

Without Screw	81.971.2
With Screw	82.961.9
Current on	
Without Screw	81 765
With Screw	83 1625
Deposit	200 6
Dissolve	206.2

81 971 2
81 765
206 2

83 1625
82 961 9
200 6

246

U

Without Screw.	81 681 2
With Screw.	84 282
Current on	
Without Screw.	81 476 9
With Screw.	84 479 7
Deposit	1971
dissolve	2043

81 681 2
81 476 9
2043

84 479 7
84 282
1977

247

J

without screw	89,717.9
with screw	86,812,3
without screw	89 5135
with screw	87 0081
deposit	1958
dissolve	2044

89 717 9
89 513 5
2044

87 008 1
86 812 3
1958

248

V

without screw	83 196 2
with screw	83 550.2
without screw	82 990 6
with screw	83 742 3
	192.1
dissolve	205.6

83 196 2
82 990 6
2056

83 742 3
83 550 2
1921

249

S

without screw	82 587.1
with screw	84 002.1
without screw	82 375 4
with screw	84 193.1
deposit	191
dissolve	206.7

82 587 1
82 375 4
2117

84 193 1
84 002 1
1910

82 587 1
82 380 3
2068

OCT 24 1881.

N

Without screw	90.095.
With screw	90 745.3
Current on	
Without screw	91 369.4
With screw	89 491.1
Deposit	1 274.4
Dissolve	1254.2

The following experiments up to "S" on page 255 which is six cell, the solution being the acetate of zinc. the cell were put in series and short circuited on a daniell cell and so that the direction of the current is opposite the preceeding one.

J

X

Without screw	89 513 5
With screw	87 008.1
Current on	
Without screw	90 786 8
With screw	85 753 9
Deposit	1.273.3
Dissolve	1.254.2

91369.4
90095
1274.4

90745.3
89491.1
1254.2

25286
25275
25295

90786.8
89513.5
1273.3

87 008.1
85 753.9
1254.2

1 mm (2527 ·
2.6

U

Without screw	82.990.6
With screw	83 742.3
Current on	~~84 2705~~
Without screw	84 2705
With screw	82 4927
Deposit	1279.9
Dissolve	12496

84 2705
82 9906
12799

83 7423
82 4927
12496

100/12.8.74(12.74
~~274~~

15295

J

Without screw	81.476,9
With screw	84.479.7
Current on	
Without screw	82 7586
With screw	83 207
Deposit	1281.7
Dissolve	12727

82 7586
81 4769
1.2817

25544

84 4797
83 207
12727

U

Without screw	82.3754
With screw	84 193.1
Current on	
Without screw	83 6539
With screw	82 9448
Deposit	1.2785
Dissolve	1.2483

83 6539
82 3754
1278 5

84 193 1
82 944 8
1248 3

1281 7 . 1281 7 . 1277
1273 3
0 8 4

S

Without screw	81 765
With screw	83 162.5
Current on	
Without screw	83 039.8
With screw	81 906 9
Deposit	1 2748
Dissolve	1 2556

deposit	dissolve
1 2744	1 2542
1 2733	1 2542
1 2799	1 2496
1 2817	1 2727
1 2785	1 2483
1 2748	1 2556

83 039 8
81 765
1 2748

83 1625
81 9069
1 2556

1277.1 being the average

Lot 4.16 1/3 of 1%
Lot 3.18 " "

256

Oct 25

N

Without screw	84.2705
With screw	82.4927
Current on	
Without screw	
With screw	
Deposit	
Dissolve	

257

U

Without screw	827569
With screw	832055
Current on	
Without screw	
With screw	
Deposit	
Dissolve	

F J

Without screw	83·6539
With screw	82·9448
Courant on	
Without screw	
With screw	
Deposit	
Dessolue	

R

Without screw	83 0398
With screw	81 9069
Courant on	
Without screw	
With screw	
Deposit	
Dessolue	

+2
+3

101

209
81

81) 209 (3.81
243
660
648
12

.0107
81

1.07

1.0107
3.81

.8507
321

.040767

100 # 75 sixty seeds

205 x 10 = 2050

280

.5)100 (200 $\frac{1}{20}$

20

$\frac{1}{8} = \frac{1}{4}$ bar

.03) 10 (333

90

10

.05) 1.4 (28 $\frac{1}{28}$

100) 140 (1.40

5) 140 (28

28

.28 140

100 28) 2700 (96

252

180

168

12

100 112) 1.00 (.04